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## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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| | | ) | | |
| FOR: | Steel Wire for Cold Forging Having Excellent Low Temperature Impact Properties and Methods of Producing Same | ) | | |

## DECLARATION UNDER RULE 132

Mail Stop ____________
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Soon-Tae Ahn, do hereby declare as follows:

1. I am the named inventor of the above-identified patent application. I have a Ph.D degree in Metal

Materials from Busan National University in Korea . I am a director at Samhwa Steel Co. Ltd., assignee of the above-identified application, and have 24 years of experience working in the manufacture of steel wire for cold forging, including shaping, heat-treating and testing of such wire. I believe that I am skilled in the art of manufacturing steel wire and am competent to testify to the matters described herein.

2. I am familiar with the above-identified application and the steel wire for cold forging disclosed and claimed in claims 1-4. I understand that these claims stand rejected from Kanisawa et al. U.S. Patent Publication No. 2002/0040744.

3. I am offering this declaration to overcome the rejection of claims 1-4 over the Kanisawa reference, specifically the invention as described and claimed in claims 1-4 is anticipated by or obvious from the Kanisawa reference.

4. The claimed method of the present invention is distinguished from the prior art Kanisawa process, wherein the heating is performed while hot rolling the steel wire. Kanisawa describes in paragraph 0033 the hot

rolling of the steel to a finish rolling temperature from the $Ar_3$ transformation temperature to 200°C above it.[1] Kanisawa also describes in the same paragraph that such hot rolling process produces a prior austenitic grain size of 11 or above. Although the achieved austenite grain size overlaps with applicants' invention, Kanisawa's processes for obtaining the fine is different. Accordingly, Kanisawa not only does not disclose applicant's heating step that occurs without plastic deformation, but in fact *teaches away* from applicants' process as defined in claim 3.

5. Kanisawa also does not disclose applicants' claimed tempering parameter (P) ranging from 21,800 to 30,000. P is expressed by a following Equation 1:

$$P = 1.8 \times (T + 273) \times (14.44 + \log t)$$

wherein, T is a tempering temperature expressed in °C and t is a tempering time expressed in sec.

6. Applicant's composition with the resultant claimed properties, as defined in claims 1 and 3, is not anticipated by or obvious from Kanisawa.

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[1] The present invention specifies the "Ac3" transformation temperature, while Kanisawa specfies the "$Ar_3$" transformation temperature. The "c" in applicants' term $Ac_3$ is taken from

The present invention solves the problem of dramatically deteriorated impact properties when a conventional steel wire for cold forging is used as in automobiles or other devices in a severely cold regions by providing a steel wire having high impact properties of 60 $J/cm^2$ or more at a cryogenic temperature of -40°C, even though the hot-rolled steel wire is quenched and tempered with high tensile strength of 70 - 130 $kgf/mm^2$. By contrast, the object of Kanisawa is to provide a steel wire rod for cold forging which can be applied to spheroidizing annealing without a preliminary drawing that is conventionally conducted before the annealing. Notwithstanding overlap in composition and prior austenitic grain size range, the Kanisawa steel wire is incapable of achieving the unexpectedly advantageous claimed properties of applicants' invention.

7. The differences may be explained by reference to Kanisawa' described treatment processes and reported properties for the steel wire. Kanisawa employs a hot rolling process in which billets of 162 mm x 162 mm in section were heated at a high temperature and continuously plastically deformed by hot rolling into wire rods 11 mm in diameter. The

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the French term "chauffage" having a meaning of heating and the "r" in Kanisawa's term $Ar_3$

finish hot rolling was at a relatively low temperature of from $Ar_3$ to 200°C above it (800°C) in order to reach the final size, following by being rapidly cooled and then tempered at 500°C. After tempering, the wire underwent spheroidizing annealing at the retention temperature of 740°C for a resident time of 17 hours. Kanisawa, Example 1 and Table 2.

8. The combination of tensile strength and impact absorption energy as defined in the claims of the present invention is also not disclosed or suggested by Kanisawa. Although the steel wire rod produced by Kanisawa immediately after hot rolling, rapid cooling and tempering in Table 3 shows a tensile strength similar with that of the present invention (up to 978 MPa = 99 kgf/mm$^2$), the steel wire rod cannot be applied to cold forging. Instead, Kanisawa teaches that the wire must undergo spheroidizing annealing, in which case the tensile strength level of the steel wire after annealing and before the cold forging is considerably lower (up to 568 MPa = 57 kgf/mm$^2$) than applicants' claimed range of 70 - 130 kgf/mm$^2$.

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is taken from the French term "refroidissement" having a meaning of cooling.

9. In my experience and opinion, the impact absorption energy of Kanisawa's wire immediately after tempering would not have been at least 60 $J/cm^2$ at -40°C, as in the present invention. This is because the method for obtaining the prior austenite grain in Kanisawa is completely different from that in the present invention (hot rolling versus no plastic deformation in the present invention), the Kanisawa microstructure (include the prior austenite grain) immediately after quenching has lots of stress in it because of severe plastic deformation during hot rolling in low temperature. It could be easily anticipated that the stresses will be hardly relieved even though the structure gets tempering after quenching, so Kanisawa acknowledges that the wire must be further spheroidized annealed before it is capable of being cold forged. [ By contrast, the microstructure of the present invention does not have that stress in it during the heat treatment step. ]

The claimed impact absorption energy of at least 60 $J/cm^2$ at -40°C requires significantly more ductility than what is obtained by Kanisawa immediately after tempering.

10. Although Kanisawa's wire ductility is improved after spheroidizing annealing (when it is ready for cold forging), the tensile

strength level of up to 568 MPa (57 kgf/mm$^2$) is considerably lower than applicants' claimed range of 70 - 130 kgf/mm$^2$.

11. Kanisawa only achieves the claimed tensile strength when it has an impact absorption energy lower than applicants' claimed range of at least 60 J/cm$^2$ at -40°C, and Kanisawa only achieves the claimed impact absorption energy when it has a tensile strength lower than applicants' claimed range of 70 - 130 kgf/mm$^2$. Only the present invention discloses and claims a steel wire for cold forging that has the superior combination of impact absorption energy of at least 60 J/cm$^2$ at -40°C and a tensile strength of 70 - 130 kgf/mm$^2$.

12. I declare further that all statements made herein of my own knowledge are true and that all statements made herein on information and belief are believed to be true; and further that I am warned that willful false statements and the like so made are punishable by fine or imprisonment or both, under §1001 of Title XVIII of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Soon Tae Ahn

Soon-Tae Ahn

March 4, 2010

Date

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